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The duration of Dutch export relations: decomposing firm, country and product characteristics

Arjan Lejour

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abstract

Using Dutch transaction-level data on international trade we find that the intensive margin drives Dutch trade growth year by year. After 6 years, new trade relations cover about 50 percent of Dutch exports. Each year 40 percent of the relations are new, but only 25 percent survives after two years. We distinguish several firm-country-product (FCP) relations characterised by the export familiarity of the firm, country or product to identify differences in survival rates. The estimates show that the hazard rates of trade relations with new exporting firms or incumbent firms to new countries are about 15 percent lower. EU membership decreases the hazard rate by 40 percent. Initial sales are also important. Relations with an initial export value of about 50 thousand euro do not survive, while those with an initial value of 200 thousand euro exist after a few years. Exports with homogeneous goods tend to have higher initial trade values and the hazard is about 10 percent lower than those with heterogeneous goods.

Key words: International trade, export duration, hazard models, export margins, firm heterogeneity

JEL classification: F10, D22

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1. Introduction

In their seminal works on export survival, Besedeš and Prusa (2006a, 2006b) show that the median duration of export spells is only two years. These authors and others have also shown that the hazard rate sharply declines with the duration of export relationships, suggesting that longer-lasting relationships have a higher future survival rate. Moreover, long-term trade relationships are responsible for the bulk in trade growth, which implies that reducing the hazard rate of export relationships eventually promotes trade growth (Bernard et al., 2009).

One important question is how short- and long-lasting trade relationships can be distinguished, not only *ex post*, but also *ex ante*. This is important for exporting firms, because of the sunk costs involved in foreign market entry (as suggested by the work of Das et al., 2007). Targeting of export markets and products may be particularly important for avoiding market entry costs which cannot be recovered if a trade relation fails. More knowledge on the *ex ante* characteristics of short and long-lasting trade relations can also relevant for governments for increasing the effectiveness of export promotion policies.

This paper aims to presents a systematic analysis of the various characteristics of the trade relations of Dutch firms.[1] It analyses export behaviour of firms by product and destination and gives thereby a complete overview of all trade relations. A problem with the export survival literature so far is that it has been conducted mainly at the product-country level. Eventually *firms* are the basic decision-makers in cross-country export relationships. What matters therefore, is the survival of firm-level export relationships at the product-country level. Most of the firm-country-product export relations are from multi-product firms. Then product survival is no longer equal to firm survival as the recent evidence on multiproduct firms suggests.[2] However, these papers concentrate on firm-product relations to a specific destination, while we consider all destinations.

The export experimentation literature[3] suggests trial and error behaviour; exporters start with small foreign deliveries to test whether exporting is profitable. If exporting is profitable they increase their exports by the intensive and extensive margins (Albornoz et al., 2012). Freund and Pierola (2010) distinguish familiar and new export destinations and products (at least for

[1] This paper builds upon earlier work on productivity and trade of Dutch firms such as Kox and Rojas-Romagosa (201), Creusen et al. (2011) and Creusen and Lejour (2013). However, these papers pay nearly no attention to the product dimension and do not consider the survival of export relations.

[2] See Iacovone and Javorcik (2010), Bernard et al., (2011) and Eckel et al.(2011).

[3] See among others Albornoz et al. (2012), Eaton et al. (2007), Freund and Pierola (2010), and Rauch and Watson (2003).

other firms). For familiar destinations and products foreign market entry costs are relatively lower. The entry and exit rates are correspondingly high. For new export products and destinations this is different. Market entry costs are much higher and this suggests that entry and exit rates are much smaller. The empirical analysis in this paper will confirm this pattern for the Netherlands.

Some recent papers distinguish export products and export destinations. Cadot et al. (2013) investigate survival of FCP- relations for firms from six African countries. The more experience a firm has with exporting a product (the number of destinations) or with the destination (the number of products) the larger is the export survival probability. However, they do not present systematic analysis of the various FCP relations as this paper does. Brenton et al. (2009) derive similar conclusions as Cadot et al. (2013) using product-country trade data for developing countries. Moreover, they conclude that the initial trade value is an important predictor for survival. This paper takes also the initial trade value into account but does so for the various types of FCP relations. Arkolakis and Muendler (2010) analyse the development of FCP relations for Brazilian firms and conclude that market-entry costs drop fast if the number of products at a particular export destination increases. Fixed entry costs can be spread over a larger number of products and the product-specific fixed costs are relatively small (and possibly decreasing with scope), but they do not address the survival probabilities of the various trade relations.[4]

Except for the few papers above, the analysis of FCP relations is underdeveloped in particular for exports from developed countries. We fill this gap by presenting a full decomposition in terms of the number of FCP relations and its trade value. Moreover, we analyse changes over time (2002-2008) and finally we try to identify firm, product and country characteristics which indicate successful/ long-lasting exports and disentangle, birth year, survival rates and growth rates. In other words we extend the ordering of market entry costs for different firm, product and country characteristics and relate this to the survival rates. After presenting the descriptive statistics we conduct an econometric analysis to identify the factors influencing the survival rate. We use continuous proportional Cox hazard models and discrete and non proportional hazard models.

[4] Miranda et al. (2012) and Amador and Opmorolla (2013) are examples of papers investigating various dynamic aspects of FCP relations with European data (Estonia and Portugal, respectively), but do no present hazard rate analyses.

The econometric results show that a higher initial trade value, EU membership, larger market size, and a smaller distance to the destination country increase the survival probability. These results are quite standard in the literature. A novel result is that EU membership reduces the hazard rate of Dutch export relations by even 40 percent. Homogenous goods reduce the hazard rate by nearly 10 percent, and trade relations characterized by new firms or new destinations have hazard rates which are about 15 percent lower. Trade relations with new products, independent of the familiarity of the destination, reduce the survival probability by 20 to 30 percent compared to new trade relations with familiar products and destinations for the firm. These effects are substantial. We are the first which identify these different characteristics. The results suggest that new export relations with new exporting firms or to new destinations survive significantly longer than those with new export products.

Trade relations with new firms or new destinations have not only higher survival rates; their initial sales are also relatively high. Measured by trade value, the survival of new exporting firms is more important for trade than the survival of new products or countries in the end. Although trial and error export behaviour also suggests some irrationality, we find that the degree of trial and error (measured by survival rates) is negatively correlated to market entry costs. New combinations of existing export products and destinations for a firm are not an advantage in terms of a higher survival rate. The initial sales are also low and these combinations do also not add much to the trade value later on. We also know that market costs are lower of these trade relations, in particular because the destination is known. This could induce firms to try out this country-product combination because the market entry costs are low.

If trade relations exist for five years the survival probability as four times as high as for new trade relations. Recurrent new trade relations have a substantial higher probability of surviving than brand new relations. The results are quite robust for various specifications of the discrete hazard models with random effects. The Cox hazard model delivers similar results, although its assumption of a proportional hazard rate is rejected.

In short, export performances of new exporting firms selling homogeneous goods to other EU countries and of incumbent exporting firms selling homogenous goods to new EU destinations are much better than of incumbent exporting firms selling familiar differentiated products to familiar destinations outside the Europe. Export experimentation seems to occur

more often by incumbent exporters with familiar products and destinations for which market entry costs are lower.

The paper is structured as follows. Section 2 presents the data sources and section 3 the basic decomposition. It also shows the development of the intensive and extensive export margins over time. Section 4 analyses the development of trade by birth year of the trade relations. This development is decomposed in section 5 and analysed by birth and survival year. Section 6 focuses on various characteristics of export products and export destinations such as homogeneous and heterogeneous goods, and EU and non-EU export destinations. Section 7 presents the econometric analysis and Section 8 concludes.

2. Data sources

The most important source for our analysis is the International Trade (IH) data set. This is a set of customs data extended with a survey across Dutch firms on international transactions of imported and exported goods between 2002 and 2008. For each transaction the IH dataset contains information on the country of destination (or origin), the type of product, the value and the volume in physical units, and the share of the export value that is related to re-exports. Each record is identified by the VAT-number and an IH relation number of a Dutch firm.[5] The IH dataset does not include intra-EU transactions of firms with total exports (or imports) below a threshold value which increases over time.[6] Firms with lower export or import values are expelled from the survey to ease their administrative burden. The IH dataset does include additional data from the Dutch Tax Authorities on the sum of all exports by firm from the VAT registration, but these totals cannot be specified towards EU countries and products. This study uses export data excluding re-exports, deflated to export price levels in 2002. Note that the analysis might be vulnerable to potential selection bias, particularly due to the threshold value in registering international trade data. In order to correct for the change in selection bias over time, we impose a threshold value of 900 thousand euro to all countries, which are member of the EU in 2007 for all years in the analysis. We analyse the data at the 5 digit product level, and ignore product switching at a more disaggregated level.

[5] To ease the identification, Statistics Netherlands has created the IH-relation number as a new identifier. This number identifies individual and actual exporters with one or more VAT-numbers, but refrains from the legal and organizational status of exporters. This study uses the IH-relation number as the main identifier of exporters.

[6] The threshold for the export value is 225 thousand euro until 2005, 400 thousand euro in 2006 and 2007 and 900 thousand euro in 2008.

Product classifications change over time considerably and we use conversion tables to make the classification consistent between 2002 and 2008.[7]

Moreover, we skip all trade transactions with a value of less than 1000 euro. This hardly affects the total value of trade in the data sample, but reduces the number of observations by about 30 percent.[8] This is a debatable threshold. In thinking about market entry, we often assume implicitly that firms are deliberately seeking market access. Most of the small observations are probably accidental exports or service deliveries and not the result of a market access strategy. In the robustness analyses we experiment with a threshold for 100 euro which adds 0.33 million observations to the sample, but this hardly affects the results.

We use the Rauch (1999) classification for distinguishing homogeneous and heterogeneous goods using his conservative classification. Reference-price goods and good traded at an organised exchange are classified as homogeneous goods.[9] Rauch made this distinction at the SITC4 classification. Using concordance tables we have linked these data with those of Statistics Netherlands based on the harmonized system at the five digit level. Due to classification changes over time we could not classify ten percent of the goods.

The firm level data are complemented with country data. For market size, we use (the log of) total GDP from the World Bank Development Indicators. Variable trade costs are approximated by the geographical distance between Amsterdam and the most populated cities of the trading partners (source: CEPII).[10]

3. The intensive and extensive margin over time

We decompose the value of trade and the number of trade relations of Dutch exporters with respect to the destination countries and export products (at the 5 digit level). As discussed extensively by Bernard et al. (2009), the variation in the number of FCP relations has various sources. First of all, new firms can decide starting to export and exporting firms can decide to

[7] Pierce and Schott (2012) find that for about half of the US trade value the product codes have changed between 1989 and 2004. The conversion tables can be found at http://ec.europa.eu/eurostat/ramon/index.cfm?TargetUrl=DSP_PUB_WELC. It is hardly duable to provide accurate conversions over six years at a more disaggregated product level.

[8] The number of observations is reduced from 1.81 to 1.27 million.

[9] We have put the reference-price goods in the group of heterogeneous products for robustness analysis and also used Rauch his liberal classification. Although the precise numbers in all these specification differ, the pattern remains the same. Therefore we do not present these results, but these are available upon request.

[10] We have also experimented with average country-level import tariffs in the regressions, besides distance, but the coefficients are not significant.

continue or to quit. Second, firms can decide to export to new destinations, to continue a destination or to quit. This is also the case for export products. Firms may add new products to a destination, export the same products or drop products. These new products could be new export products of the firm or existing export products of the firm but sold at new destinations. Similarly, a dropped product at a specific destination could still be a part of the export portfolio of a firm.[11]

Let's call Y_t the national trade value of firm-country-product export relations at time *t*.

$$(1) \qquad Y_t = \sum_{f \in OF} Y_{ft} + \sum_{f \in NF} Y_{ft}$$

The trade value in period *t*, equals the trade value of incumbent exporters (already exporting last year), denoted by *OF*, and the new exporters at time *t*. The set of new exporters is *NF* and varies by year. The incumbent firms can export to known (is old, *OD*) and new destinations (*ND*). The sets of old and new destinations are firm specific and time-varying.

$$(2) \qquad \sum_{f \in OF} Y_{ft} = \sum_{f \in OF} \left(\sum_{c \in OD} Y_{fct} + \sum_{c \in ND} Y_{fct} \right)$$

The incumbent firms can sell their familiar export products or new products at known and new destinations. *NP* (OP) represents the set of new (old) products, which are firm and time specific.

$$(3) \qquad \sum_{c \in CD} Y_{fct} = \sum_{c \in CD} \left(\sum_{p \in OP} Y_{fcpt} + \sum_{p \in NP} Y_{fcpt} \right) \qquad CD \in OD, ND$$

Finally, familiar products at an old destination can be a familiar product for firm *f* at that destination *c* (OCP) or a familiar product at other destinations (NCP).

$$(4) \sum_{p \in OP} Y_{fcpt} = \sum_{p \in OCP} Y_{fcpt} + \sum_{p \in NCP} Y_{fcpt}$$

Substituting equations (2) to (4) in equation (1) gives the total export value decomposed into

[11] A similar reasoning holds for export destinations. It could be a new destination for the firm, but also a familiar destination which is only new with respect to a particular export product.

$$Y_t = \sum_{f \in OF} \left(\sum_{c \in OD} \left(\sum_{p \in OCP} Y_{fcpt} + \sum_{p \in NCP} Y_{fcpt} + \sum_{p \in NP} Y_{fcpt} \right) + \sum_{c \in ND} \left(\sum_{p \in OP} Y_{fcpt} + \sum_{p \in NP} Y_{fcpt} \right) \right) + \sum_{f \in NF} Y_{ft} \quad (5)$$

The first term represents the intensive margin: the trade value of incumbent export firms to known destinations and selling familiar products to these destinations. All other terms represent various characteristics of the extensive margin. The second and third term represent the sales of new products at old destinations distinguished by a familiar export product at other destinations for the incumbent firm (second term) and a new export product (third term). The fourth and fifth term represent sales of incumbent exporting firms to new destinations with old export products (fourth) and new export products (fifth). The final term represents the export value of new exporting firms which are by definition also new destinations and new export products for the firm. To economize text phrases and notation we use the term *new products* for new products at a familiar/old destination (third term) and *new destination* for familiar products at a new destination (fourth term).

We estimate these margins year by year and for the full period of six years. In the latter case the trade value in 2008 is equal to the value of the intensive margin, based on all existing firm-country-product relations in 2002 (and still exist in 2008) plus the varying extensive margins based on new trade relations since 2002 (and still exist in 2008). Table 1 presents a summary of the development of the extensive and intensive margins. The total export value is 65.8 billion euro in 2003 of which 58.8 billion comes from firm-destination-product relations that exist in 2002 and 7 billion euro comes from new trade relations. At an annual base nearly 90 percent of the exports are generated by existing trade relations and only 10 to 12 percent by new relations. For the whole period 2002 to 2008 the extensive margin is much more important: nearly 50%. In the US, existing FCP relations are responsible for more than 80 percent of the export growth although this varies between 46 percent and 294 percent (Bernard et al., 2009). Over a ten year period existing FCP relations only contribute a third to US export growth.[12] Our year-by-year results vary less than those for the US. The main reason is that we decompose the value of exports, while Bernard et al. (2009) focus on the value of export growth. This and the shorter time interval explain that the intensive margin is more important than in Bernard et al. (2009). These authors explain the importance of the

[12] Halpern and Muraközy (2011) find that in 2003 73% of all Hungarian exports are generated by firms starting to export after 1992.

intensive margin by the fact that the value of new trade relations is much smaller than that of existing relations. Over time, conditional on survival, new relations develop much faster than existing relations which explains the increasing importance of the extensive margin over time. Later on we will compare in more detail the trade values of new and existing trade relations.

Trade relations are new because firms start exporting or incumbent exporters sell new products, sell to new destinations or do both. It is also possible that they export a product to a new destination which was already served by other products of the firm. The decomposition in Table 1 shows that new products contribute most to the new FCPs followed by new destinations and by new firms, although there is considerable variation over the years. The combinations of new products and destinations and new combinations of existing export products and destinations add less to the extensive margin. Over the whole period 2002 to 2008 the contributions of new firms is most important followed by new products of incumbent firms and new destinations. New combinations of existing export products and destinations do not add much to the trade value.

The differences between year by year changes and six-year period changes suggest that new export firms grow faster or survive more frequently than trade relations with new products or destinations. The opposite is the case for combinations of known products and destinations. These conjectures will be analysed in more depth in the remaining of this paper.

Apart from the trade value we also decompose the number of trade relations in incumbent trade relations and new trade relations decomposed by the same five characteristics as in equation (5). The number of trade relations, A_t is equal to:

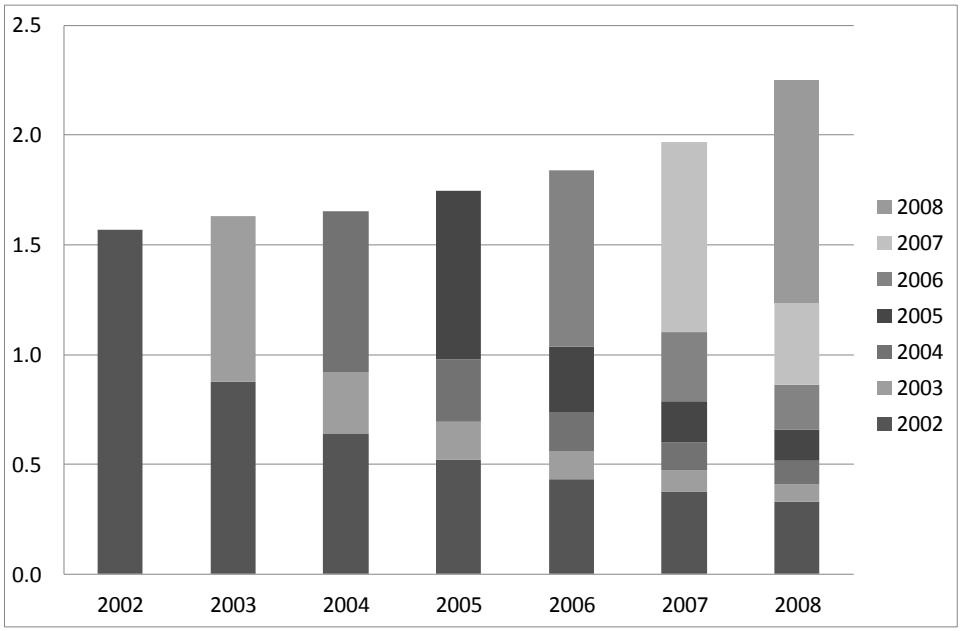
$$A_t = \sum_{f \in OF} \left(\sum_{c \in OD} \left(\sum_{p \in OCP} A_{fcpt} + \sum_{p \in NCP} A_{fcpt} + \sum_{p \in NP} A_{fcpt} \right) + \sum_{c \in ND} \left(\sum_{p \in OP} A_{fcpt} + \sum_{p \in NP} A_{fcpt} \right) \right) + \sum_{f \in NF} A_{ft} \quad (6)$$

A_{fcpt} is a dummy which is one if the FCP relation exists in period t and zero otherwise. f indicates an exporting firm, c the export destination and p the export product. The symbols for the sets of firms, countries and destinations are the same as in equations (1) to (5).

4. Basic Results by birth year

A more detailed way to examine the dynamics of the trade relations is a decomposition by birth year. Figure 1 presents the number of firm-country-product relations from 2002 to 2008. The number of FCP relations increases with 43 percent between 2002 and 2008 which indicates the internationalization of business. Trade increased from 66 to 102 billion euro in that period, a real increase of 55 percent. The total number of FCPs is distinguished by the birth year of the FCP relations in the columns. For the starting year of the sample, 2002, we do not know whether the trade relations are new or old. The upper part in the columns reflects the number of new FCP relations. This is about 40 percent of the relations in a given year. New is defined as a FCP relation that did not exist the year before. This could be a brand new relation but also a recurring relation which existed two or three years ago. Later on we will distinguish the recurring new relations from new ones (robustness analysis).

Figure 1: Number of FCP relations (per 100 000) between 2002 and 2008 and their birth year.



Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Figure 1 clearly depicts the dynamics of new trade relations. If all these new relations would survive for some years, the increase in FCP relations would be much higher than 43%. However, this is not at all the case. Although many FCP relations are new, most of them do not survive for a long time. In 2008 only 15 percent of the FCP relations lasted for at least six

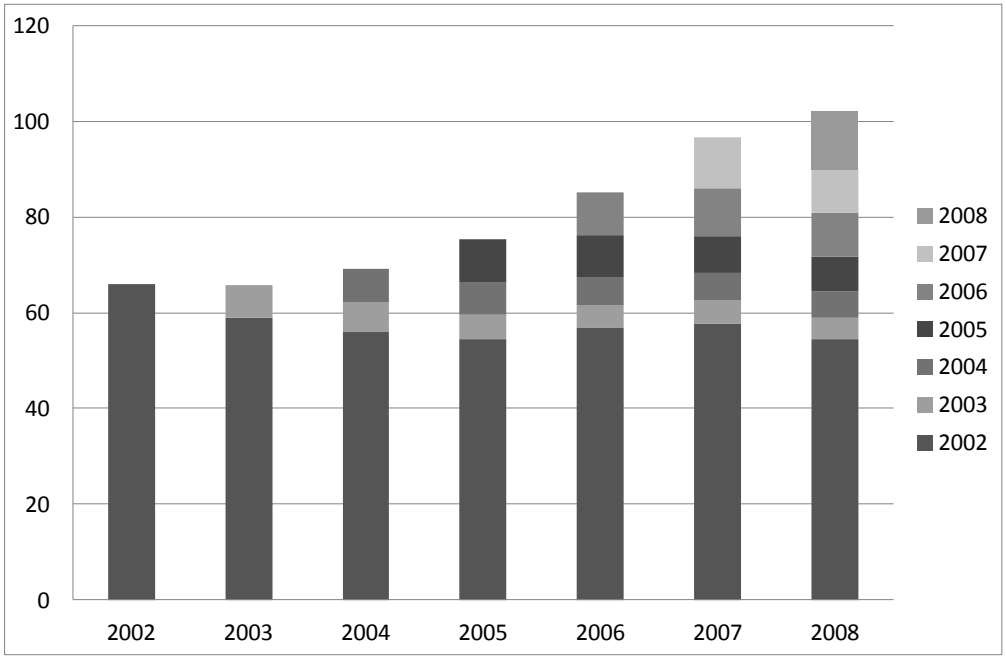
years (Table 2). In 2008 only 20 percent of the 2002 relations has survived and the majority of these surviving trade relations are probably incumbent relations in 2002. For new FCP relations the survival rate is even lower. In four or five years, 85 percent of the new FCP relations vanish according to Table 3. This table presents the shares of the relations borne in a year (reflected in the columns) by the year of survival, where 2002 includes also export relations established in earlier years.[13] The table concludes that about 60 percent of the new relations disappears within one year and that nearly 15 percent only exists for two years.

Although only 20 percent of the FCP relations originating from 2002 or earlier still exist in 2008 (see Figure 1), the impact on the trade value is large. In spite of the fact that 80 percent of the FCP relations is lost, the trade value is still about 55 billion euro in 2008 (the intensive margin, see section 3), suggesting a massive rise in the average export value of a FCP relation from 2002 or earlier. These relations are still responsible for half of the trade value in 2008 as can be seen in Figure 2. For the new trade relations, it seems that the latest birth year is most important and that its importance decreases the longer the birth year is away from the actual year. This seems to be a recurring pattern for all available years.

The average export value of a FCP relation is about 400 thousand euro. Due to new FCPs the average over all trade relations increases only by 10 percent. The average export value of new relations is about 100 thousand euro and increases fivefold in about four years' time. The export value of the 2002 relations increases four times to 1.6 million euro. The main reason is that many exporters from 2002 with relatively low export values retreat from the international markets in later years. The average trade value of FCPs existing for one year is about 50 thousand euro (see Table 4), only for 2008 it is substantially higher. For FCPs which are active for two to four years the average trade value in the birth year is 100 to 150 thousand euro. For FCPs with a longer time span the initial trade value is substantially higher on average, about 250 thousand euro. Initial sales seem to be a good indicator for the survival of the firm-country-products export relation as is also concluded in studies with country-product data (Brenton et al., 2009, Prusa en Besedeš, 2006a).

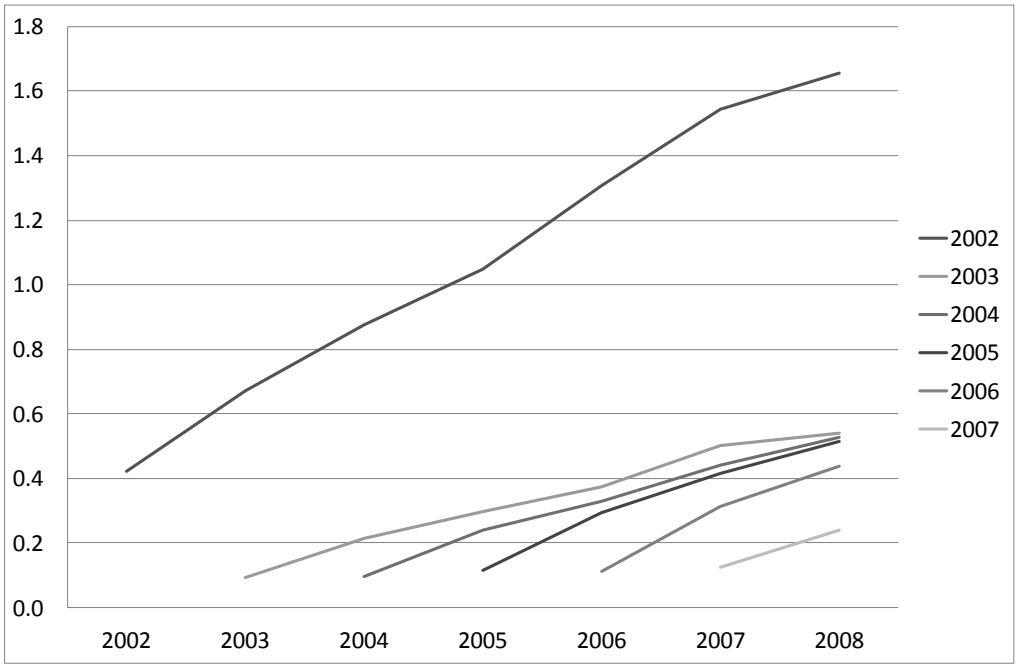
[13] Tables 2 and 3 are based on the same number of FCP relations in the cells, but are presented as shares within a row (Table 2) and shares within a column (Table 3).

Figure 2: Development of trade value between 2002 and 2008 by birth year of trade relations in billion euro.



Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Figure 3: Development of average trade value per FCP relation between 2002 and 2008 by birth year in million euros.



Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

5. Decomposition of new trade relations

The new trade relations can be characterized by new firms, new products, new destinations, new products and new destinations, or new combinations of familiar products and destinations. We estimate this decomposition for the birth year and subsequent years. Table 5 presents the results averaged by age of the new FCPs; standard deviations are presented in parentheses.[14] The overwhelming share of new trade relations comes from incumbent exporting firms (see the row on birth). The share of new exporting firms is hardly 10 percent of all new FCPs in the birth year. This share increases to about 15 percent four to five years later which is still a modest share and illustrates the important role of incumbents in trade. However, the increase over time implies that relatively more new firm relations survive than those of incumbent firms.

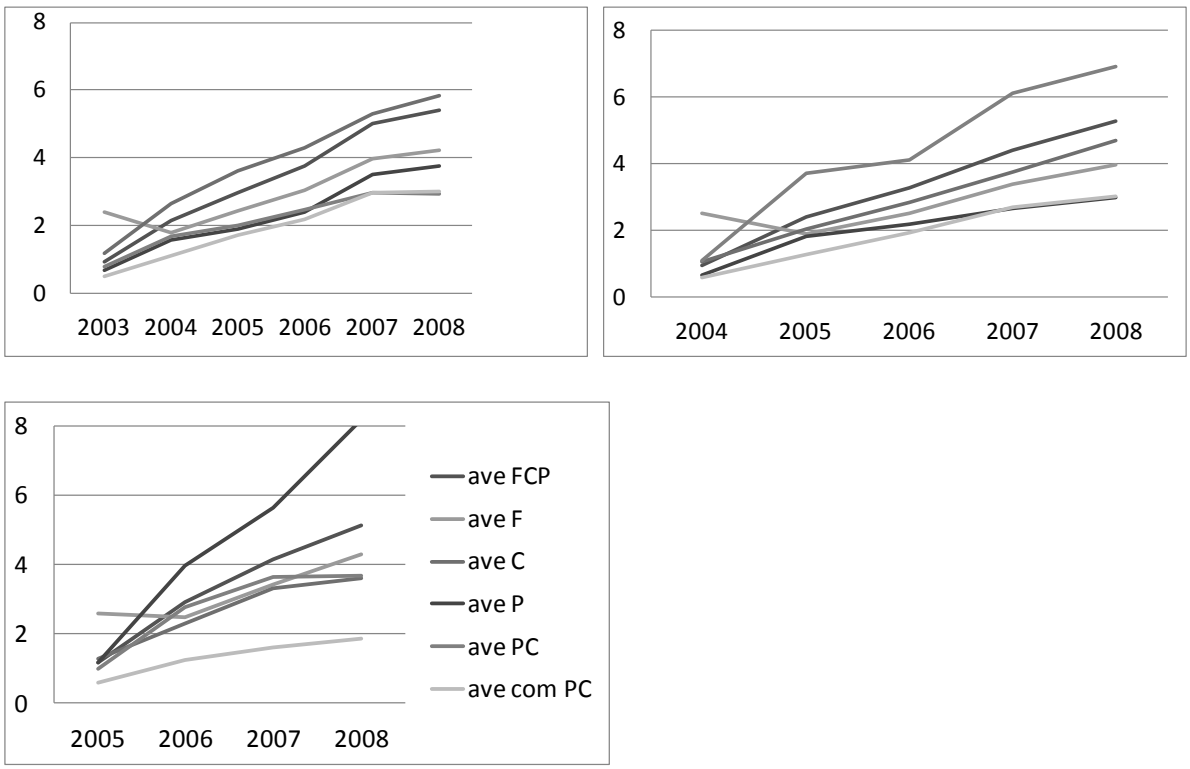
Nearly a quarter of the new FCP relations are new destinations. After four to five years the share of surviving FCP relations increases to 32 percent. This is different for firms sell new export products to new destinations. In the birth year this share is on average 14 percent and decreases by about 4 percentage points after four years. The survival rate of this these FCP relations is relatively low. Also for new products to known destinations, the survival rate is low, at least lower than for the average new FCP relation. The share of new products in new FCPs decreases from 31 to 19 percent after four years. Incumbent exporters also expand their export product-destination mix by selling familiar export products to destinations known from other export products. This is nearly a quarter of the new FCP relations and this share remains constant.

From comparing Tables 5 and 6 we find that new firms are much more important for the value of trade than for the number of trade relations. Moreover, the value increases substantially over time, to a third of the export value of new FCPs. The average export value of new export firms per product and destination is much higher than for other new FCP relations in the birth year, but the growth rate of average export value is lower for surviving export firms (see Figure 4). The export value of new combinations of familiar products and destinations is only responsible for one seventh of the export value of new FCP relations, much smaller than their 25% share in number of relations. This reflects a low average export value, suggesting that these sales are try outs without much investment effort beforehand

[14] Detailed results by year can be found in the annex.

because the export products and destinations are familiar (Freund and Pierola, 2010). Over time the export values increase fivefold, but remain much lower than for other types of FCP relations as can be seen in Figure 4. The new product and destination relations do not add much to the total trade value; this share corresponds more or less to the share in FCP relations. The development of trade values of the FCPs with new products or new destinations is more dynamic and varies by year. The average export value of FCPs with new products is much higher and increases relatively over time, although 2005 is an exception. However, the low survival rates imply that the contribution to total trade declines from nearly 30 to 12 percent.

Figure 4: Development of average sales of 2003, 2004 and 2005 cohorts (in hundred thousand euros).



Although a relatively large share of the new FCPs involves new products, this alters rather quickly after a few years due to the high hazard rate of new products. This suggests that it is easier for firms to change the export product composition than it is to change the export destination composition. The product churning literature (Bernard et al, 2011, Iacovone and Javorcik, 2010) also suggests that it is quite easy to add and drop products because market entry costs are lower for products at familiar destinations than market entry costs at new destination. However, this literature does not compare product churning with destination churning.

This would suggest that export values to new destinations are higher than export values of new products. The opposite is often the case, however, and export values of new products to familiar destinations are even higher than to new destinations. On the other hand, initial export values of new exporting firms are higher than for the other types of FCPs, but export growth is much lower than for other FCP relations. Moreover, the survival rates of trade relations with new firms or new destinations are substantially higher than for other categories, suggesting that export experimentation is less common if market entry costs are high.

6. Product and destination characteristics

This section examines in more detail the product and country characteristics of the trade relations. First, we use the product classification of Rauch (1999) to check whether trade relations with homogeneous goods behave differently over time than those relations with heterogeneous goods. Second, we focus on country characteristics whether the export destination is a EU country or not.

6.1 Homogeneous and heterogeneous goods

We use the conservative classification of Rauch (1999) to disentangle homogeneous and heterogeneous products. One could imagine that differentiated products are more customized and are produced in smaller quantities because of that reason. As a consequence, these products are more vulnerable for market entry costs. Besedeš and Prusa (2006a) conclude that the initial export sales of differentiated products are smaller than for homogeneous products, but that their survival rates are higher.

We have twice as much FCP relations with heterogeneous products than with homogeneous products, see Table 7. [15] We only present the results for 2008, but this year is representative for the other years. Moreover, the average trade value of a FCP relation with heterogeneous products is about twice as low as for homogenous products. This confirms our conjecture that heterogeneous products are sold at smaller quantities. For heterogeneous goods we have relatively more new FCP relations with new products irrespective of the destination, and less so with new combinations of familiar products and destinations. This follows from Table 8. It

[15] Note that the number of FCP relations and the aggregate trade values of heterogeneous and homogeneous products do not add up to those in Table 2 and Figure 2, because we could not characterize the product in about 10 percent of the trade relations. As a robustness analysis we have also considered reference price goods as heterogeneous goods. Of course the number of trade relations and trade value increases for these goods, but the pattern of decay and differences between both types of goods did not change. Rauch (1999) has also introduced a liberal classification in which more goods are classified is homogenous. This is in our sample about 5 to 10 percent of the observations. This does not have a big impact on the results. The results of both robustness analyses are available upon request.

seems to be less easy to sell a differentiated product at a new destination, but the increase over time does not differ from trade relations with homogeneous products. Slightly larger shares of the new FCPs are new firms with homogeneous products and their share increases faster over time. With differentiated goods the share of new products in the FCPs is slightly larger, but the decline over time is comparable to the pattern of FCPs with homogeneous goods.

As for the full sample, we have also distinguished new FCP relations in a given birth year by survival year for homogeneous and heterogeneous goods (Table 9). Less FCP relations with heterogeneous goods survive the first year than FCPs with homogeneous goods. After the first year the survival rates of exporting heterogeneous goods improve, but after four or five years the survival rates of export relations with homogeneous goods are still somewhat higher. This contrasts the findings of Besedeš and Prusa (2006a). However, they investigate US import country-product relations for 12 years, while we analyse Dutch export firm-country-product relations of one country for six years, which makes it hard to compare both outcomes. It could be that the survival rates for differentiated goods improve relatively over a longer time period. Moreover, our survival rates could also be lower because these are firm specific.

6.2 EU and non-EU export destinations

We split the sample in EU and non-EU destinations as an approximation of the distance to the Netherlands and the relative similarity of the market. We also include the EFTA countries Switzerland, Norway, Iceland and Liechtenstein in the EU sample, because these countries are at a similar distance as the EU countries from the Netherlands and a part of the European Economic Area. From Table 7 we find that 60 to 65 percent of the FCP observations have an EU destination. This is not surprising: 70 percent of the total value of Dutch exports remain within Europe. In this sample it is even 80 percent. The average value of the FCP relations with an EU destination is often 50 percent larger or even more than with a non-EU destination. The share of new exporting firms is considerably higher for EU destinations than for non-EU countries (Table 10). The underlying reason is probably that market access costs for EU destinations are much lower than for non-EU ones (Creusen et al., 2011). Firms start more often exporting to European destinations before they sell to other destinations. The share of new destinations in the FCPs is much higher for non-EU destinations. This seems obvious because there are much more non-EU countries than there are EU countries, but

many of the firms looking for destinations outside Europe could also decide to find new destinations in Europe which are on average less far and have a larger market size.

The decay of new product and country relations for non-EU destinations is much larger than for EU-destinations. It seems to be more difficult to survive with new products at new destinations outside Europe. This is also true for new products at existing destinations, although the decay is not so large. Firms are more successful in new combinations of familiar products and non-EU destinations. This share increases over time to a third of the number of trade relations while it remains constant for EU destinations.

As for the full sample we have also distinguished the new FCP relations in a given birth year by survival year for EU and non-EU destinations (Table 11). FCPs with EU destinations have much higher survival rates than those with non-EU destinations. The survival rate of the former is 20 percent after three years, while this is twice as low for the latter FCP relations. Comparing EU and non-EU destinations the higher market entry costs in the latter countries does not seem to prevent export experimentation. The average export value towards EU countries is higher than for non-EU countries, but we find no different pattern if we distinguish the survival years compared to the full sample.

Instead of a country classification in EU and non-EU countries we have also classified the countries according to the number of days need to import a container (data Doing business indicators of WB).[16] The results between the EU and market access criteria hardly differ, which also suggests that market entry costs are much higher for non-EU destinations on average. Because of space constraints we do not present them.

In considering new trade relations, we defined *new* as a trade relation which did not exist the previous year. It could be the case however that these FCP relations have existed two or three years ago. Then firms already paid the market entry costs and market experience such that market access is probably easier than for brand new trade relations. We define brand new trade relations as the ones which did not exist before in the sample period 2002 to 2008. This definition has two consequences. First, only from 2004 we can distinguish both kinds of new trade relations. The decompositions for the years 2002 and 2003 will not change. Second, a trade relation characterized as 'brand new' could have been there before 2001. However, it is less likely that the brand new trade relations include before 2002 trade relations if we reach the end of the sample period. Table 7 shows that the number of brand new relations is 25%

[16] If the number of days was 7 or less we labeled them as easy access countries and otherwise as difficult access countries.

lower in 2008.The share of recurrent trade relations is relatively modest. Further, a not presented analysis shows that the average trade values of new and recurrent relations is similar. Also the survival rates hardly differ.

7. Estimation results

The preceding sections discussed various factors affecting the duration of new trade relations such as the status of the firm, product and destination and the initial trade value. This section aims to estimate the impact of these factors. Traditionally, the economic literature uses Cox proportional hazard models to estimate survival rates.[17] Recent papers have convincingly argued that the assumption of proportional hazard is violated (Brenton et al. (2009), and Hess and Person, 2011 and 2012). Moreover, Hess and Persson (2012) argue that the coefficients are also biased due to the many tied duration times (using year data) and that it is nearly impossible to control for unobserved heterogeneity. These arguments hold in particular for large datasets like trade spells. Brenton et al. (2009) have used the discrete-time version of the Cox model, the so called cloglog model, to deal with unobserved heterogeneity. Moreover, a discrete model fits better to the trade duration data which are yearly data than a continuous-time estimation model. However, the approach of Brenton et al. (2009) does not solve all problems, in particular not if the hazard rate is intrinsically non-proportional, which can be easily tested (Hess and Persson, 2012).

Following most other papers, we first estimate a Cox proportional hazard model, but test whether the hazard rates are proportional. Then, we estimate various discrete-time models with various distributions such as the cloglog, logit and probit model. This procedure is also followed by Hess and Persson (2012). First, we compare the outcomes of the various methods. Subsequently, we interpret the outcomes of our preferred specification and present various robustness checks.

We explain the duration of a trade relation by the initial trade value in the starting year of the spell, the number of product-destination spells of a firm (indicating the size of the firm), EU-membership of the destination and market size (measured by GDP). We include a dummy indicating the homogeneity of the good (a 0 implies heterogeneity) and dummies characterizing the new FCP relation by a new exporting firm, a new destination for the firm, a

[17] See Besedeš and Prusa (2006a), Nitsch (2009) and Fugazza and Molina (2009) among others.

new export product for the firm or a new export product and destination for the firm. Note that if these four dummies are zero the trade relation is a new combination of a familiar product and destination.

Column (1) of Table 13 presents the estimated coefficients of the traditional continuous-time hazard model. A negative coefficient reduces the hazard or, to formulate it differently, increases the probability of survival. A higher initial trade value, more product-destination spells, EU membership, larger market size, and a smaller distance to the destination increase the survival probability. This is also the case for homogenous goods and trade relations characterized by new firms or new destinations. Trade relations with new products reduce the survival probability, but the effect is not significant if it is also a new destination. The year dummies are significant.

If we switch to the discrete-time hazard models in columns (2) to (4), we find that the coefficients for the homogeneity of goods and market size are not significant (except for the one of homogeneity in the cloglog specification). The sign of the dummy for new products switches and indicates an increase in the trade duration in the logit and probit specifications. This is also the case for new products in new destinations. The absolute magnitudes of the coefficients in the logit estimator are larger than in the probit and cloglog estimators. Most of the coefficients in the latter two estimators are more or less similar. The log likelihoods indicate that the cloglog specification is preferable.

However, the cloglog model assumes also a proportional hazard rate. We test the proportional hazard assumption using the test on Schoenfeld residuals. It tests whether there is a nonzero slope in a generalized regression of the scaled Schoenfeld residuals on functions of time (see Cleves et al. 2004). Table 14 shows that the global test rejects the assumption of proportionality. The detailed test shows that this is caused by the initial trade value, the EU dummy, the dummy for homogeneous goods (at 5% significance), and the dummies characterizing the FCP relations.

Columns (5) to (7) in Table 13 present the regression results assuming random effects. We use cloglog, logit and probit panel regressors. The number of observations is much higher than in the earlier regressions because those ignored the time dimension of the trade spells. Each observation was a different trade spell in these regressions and we had to ignore repeated trade spells. The regressions have the same explanatory variables as before, and have been extended with dummies for the duration of the spell at time t and the number of

times a spell recurs.[18] Most of the coefficients are significant and have the same sign as before. The size of the coefficients is larger, varying from 30% to 100% compared to the same discrete hazard model without random effects. Different from some earlier regressions, trade relations with homogeneous goods seem to survive longer than relations with heterogeneous goods. This also holds for destinations with a large market. Trade relations with new products irrespective of the destination increase the hazard rate. For the trade relations with a new product this is the same result as in the Cox model.

According to Hess and Persson (2012) ρ can be interpreted as the degree of individual variation in the hazard rate due to unobserved factors. If we include year and duration dummies the degree is fairly small and insignificant according to the χ^2 test. The outcomes of the regressions are robust for the estimation method. It does not matter much whether a cloglog, logit or probit function is used. Because the cloglog model assumes a proportional hazard, which is rejected, we prefer the logit model; the log likelihood performs slightly better than the one of probit model. The coefficients are larger than in the probit model, but this is a standard result in the literature.

Table 13 presents the results of the estimated coefficients for the comparability between the various estimation methods. The literature presents often odds ratios where coefficients smaller than 1 suggest a positive impact on survival and coefficients larger than 1 a negative impact compared to the baseline. We do so in Table 15; the first column presents these effects of the preferred logit estimator in Table 13. The odds ratio of about 0.8 on the initial export value is somewhat lower than in Brenton et al. (2009), and Besedeš and Prusa (2006a). The odds ratios on GDP and distance are comparable to Besedeš and Prusa (2006a), but closer to one than in Brenton et al. (2009). The ratio on homogenous goods suggests that these trade relations have a 10% higher survival probability than trade relations with heterogeneous goods, while the literature finds a higher hazard rate. However, most of the literature uses international trade database by product and country characteristics and do not distinguishes firms. Trade with EU countries is enormous important for survival of Dutch trade relations. The hazard rate is about 40% lower. A common market and common rules do support the duration of trade relations. Characterising trade relations by new firms, countries and products learns us that the hazard rate is 15% lower for new exporting firms compared to

[18] It was not possible to include this variable in regressions (1) to (4) in Table 13.

incumbent firms, that new destinations lower the hazard rate by nearly 17%, but that new products increase the hazard rate by 32% and 22% for familiar and new destinations respectively. These are substantial differences in the hazard rates.

Hazard rates are much lower if trade relations are established for the second or third time. A brand new FCP relation has a 73% higher hazard rate compared to recurrent relations (denoted by the coefficient of the dummy first spell). Brenton et al. (2009) find that recurrent relations have a nearly 60% lower hazard rate than new relations. We also discriminate between a first and second revival of trade relations (dummy second spell). The former has a 26 percent higher hazard rate. Over time the hazard rate declines. This is a well established fact in all papers. We have used duration dummies in the regressions and find that a new relation has a four times higher hazard rate than trade relations which continue for at least five years. In the second year the hazard is already twice as low as in the first year.

For a robustness check on the explanatory variables and observations we present a set of new regressions in the other columns of Table 15. For all regressions we use the panel logit estimator with random effects. The results can be compared with column (1). Column (2) presents the regressions results ignoring the dummies for year, duration and the frequency of spells. All coefficients are substantially larger in absolute size than in our preferred specification. The qualitative results remain the same, as is the case for all regressions in Table 15. ρ, indicating the degree of heterogeneity affecting the hazard rate, is about 50%. This is large and significantly different from zero. This suggests that heterogeneity matters, and that we should use panel estimators with random effects. In principle the proportional Cox hazard model can also take account of heterogeneity (or frailty as it is often called in the hazard rate literature), but not with the amount of observations as in this dataset. About 10 thousand observations are trade spells occurring for a second or third time. We dismissed these from the regression in column (3), but their impact is minimal, only the coefficients for GDP, the dummy for new firms and for new products and destinations, differ in size compared to column (2). Column (4) shows that the dummies for the spell frequency have some effect on the size of the coefficients on the dummies on the firms, product and country characteristics of the new trade spell. Including duration dummies reduces the size of most regression coefficients. Also ρ becomes much smaller, but is still significant (see column (5)). Year dummies also reduce the heterogeneity according to the results in column (6) of Table 15. This certainly is the case for the combination of year and duration dummies. This combination resolves nearly all heterogeneity as can be seen in column (7). The year and

duration dummies interact with each other because, a longer duration of the spell implies that the spell exists in later years of the sample, but both types of dummies are necessary to discriminate year and duration characteristics.

8. Conclusions

This paper utilizes new Dutch transaction-level data on international trade to investigate the duration of firm-country-product (FCP) export relations between 2002 and 2008. We classify products at the five digit level and exclude all transactions less than 1000 euro, oil and gas products and re-exports. First, we establish that the intensive margin drives trade growth year by year. However after 6 years, new trade relations are responsible for about half of the Dutch export value. Each year 40 percent is new, but only 25 percent survives after two years. The average export value of new relations is about 100 thousand euro and increases fivefold in about four year's time. This is still much smaller than the average trade value of incumbent relations.

We distinguish new trade relations by new exporting firms and incumbent firms exporting new products, to new destinations, new products to new destinations or new combinations of familiar products and destinations. In the longer term, the export value of new firms add most to trade, followed by new products, new destinations and its combination. New combinations of familiar products and destinations are not very important due to low initial sales and low export growth rates. Initial sales are a good indicator for survival. Relations with an average initial export value of 50 thousand euro, have nearly no probability to survive, while those with an initial value of 200 thousand euro will exist after a few years. New firms have higher initial sales (factor 2) and the survival rate is 15 percent higher, but lower growth rates. That is also the case for trade relations to new destinations. New products have a 30 percent lower survival rate, average initial sales and growth rates vary by birth cohort. All these results follow from descriptive and econometric analyses with discrete hazard rate models.

We also distinguish homogeneous and differentiated goods, using the conservative classification of Rauch. Homogeneous goods have higher average trade values in the initial and later years. New trade relations with homogeneous goods have 10 percent better survival rates. After the first year the survival rates of export relations with heterogeneous goods improve, but after four or five years the survival rates of export relations with homogeneous

goods are still somewhat higher. A larger share of the new relations with homogeneous goods consists of new exporting firms and their share increases faster over time. New FCPs with heterogeneous goods have more often new products (and new destinations).

Moreover, we distinguish EU and non-EU destinations. Average sales to EU destinations are often 50 to 100 percent higher and survival rates are 40 percent higher. After three years the former is 20 percent while this is 10 percent for the latter FCP relations. The share of new exporting firms is considerably higher for EU destinations than for non-EU destinations, which is probably related to the size of to market access costs (Creusen et al., 2011). The share of new destinations in de FCPs is much higher for non-EU destinations, but the decay of new product and country relations for non-EU destinations is much larger. Firms are more successful in new combinations of existing products and non-EU destinations. This share increases over time.

Survival rates seem to be higher if market entry costs are higher. This could be due to a selection effect. As with starting to export, the more productive and larger firms are more inclined in exporting. This could also be the case for higher market entry costs. Another reason could be that market entry costs are too high to experiment with exporting because the financial burden of export failure is too high. This suggests a causal relation between market entry costs and survival rates. Something similar could be the case with the size of initial sales. Higher initial sales indicate better survival chances, but it is not clear whether this is a causal relationship or a selection effect.

In this paper we have presented a complete description of long and short-lasting trade relationships. We have a better understanding which kind or relationships have better survival chances. However, we did not determine the underlying motivations and characteristics of firms when they decide to enter a new export destination or product. Further analyses would require a link between the firm-level trade data and other firm characteristics.

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Table 1 Development of the intensive and extensive margins in billion euro between 2002 and 2008

type FCP	code	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2002-2008
new FCPs		7.0	7.1	8.9	9.0	10.8	12.3	47.5
new firms	NF	1.7	1.7	1.8	2.5	1.8	1.7	18.9
new destinations	OF,ND,OP	2.0	1.9	2.3	2.0	1.9	3.1	8.2
new products	OF,OD,NP	1.5	1.5	2.7	2.2	3.5	4.7	10.1
new des & prod	OF,ND,NP	0.9	1.0	1.1	1.2	1.7	1.3	7.1
old des & prod	OF,OD,NCP	0.9	1.0	1.1	1.1	1.9	1.6	3.2
intensive margin	OF,OD,OCP	58.8	62.1	66.5	76.2	85.9	89.7	54.5
total		65.8	69.2	75.4	85.2	96.6	102.0	102.0

Note: rows new FCPs and intensive margin add up to total. The other five rows add up to new FCPs. The codes in the second column refer to the subsets defined in section 3. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 2 The share (%) of export relationships (firm-country-product) by birth year and total number

Birth year/ survival	2002	2003	2004	2005	2006	2007	2008	total
2002	100							156994
2003	53.8	46.2						163124
2004	38.7	16.9	44.4					165534
2005	29.7	9.9	16.3	44.1				174703
2006	23.6	6.9	9.7	16.3	43.6			183984
2007	18.9	5.0	6.6	9.5	15.9	44.1		196938
2008	14.7	3.7	4.7	6.3	9.2	16.6	45.0	224762

Note: cells in rows add up to 100, except for the last one. The last column is the total of FCP relations within a year. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 3 share (%) of finishing FCP relations of new cohorts by survival year

Birth year/ survival	2002	2003	2004	2005	2006	2007	2008
2002	44.1	.	.	.	.	.	.
2003	15.1	63	.	.	.	.	.
2004	7.8	14	61.4	.	.	.	.
2005	5.4	6.3	14.4	61.1	.	.	.
2006	3.9	3.7	6.5	14.7	61	.	.
2007	2.8	2.2	3.4	5.9	13.3	57.1	.
2008	21	10.9	14.4	18.3	25.7	42.9	100

Note: cells in columns add up to 100%. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 4 Average trade value (in hundred thousand euro) of new cohorts by survival year

Birth year\ survival	2002	2003	2004	2005	2006	2007	2008
2002	1.2	.	.	.	.	.	.
2003	2.5	0.5	.	.	.	.	.
2004	3.9	1.1	0.6		.	.	.
2005	4.2	1.2	1.0	0.6	.	.	.
2006	3.7	1.4	1.4	1.4	0.5		.
2007	6.0	1.3	1.0	1.5	1.0	0.6	.
2008	11.7	2.5	2.4	2.8	2.6	2.0	1.2

Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 5 Average share of decomposed FCP relations by birth year and over time (standard deviation between brackets)

survival year	New firms	New products	New countries	New cty-prod	Old cty-prod	obs.
Birth	8.9	30.9	22.6	14.0	23.7	6
	(0.35)	(1.72)	(1.13)	(1.10)	(0.61)	
One	11.0	26.4	25.8	10.1	26.7	5
	(0.59)	(3.18)	(2.61)	(1.23)	(0.81)	
Two	12.7	23.1	27.9	9.9	26.4	4
	(1.21)	(1.52)	(2.01)	(1.47)	(1.18)	
Three	13.7	21.3	29.7	9.3	26.0	3
	(0.83)	(2.05)	(2.27)	(1.77)	(1.21)	
Four	14.7	19.5	32.1	9.2	24.5	2
	(0.76)	(1.53)	(0.58)	(2.51)	(0.80)	
Five	14.5	18.2	32.8	11.4	23.0	1

Note: cells in columns 2 to 6 in a row add up to 100%. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 6 Average share of decomposed trade value by birth year and over time (standard deviation between brackets)

survival year	New firms	New products	New countries	New cty-prod	Old cty-prod	obs.
Birth	20.2	23.9	29.2	13.0	13.8	6
	(5.03)	(4.15)	(6.71)	(1.87)	(2.22)	
One	26.5	23.1	24.0	11.3	15.1	5
	(4.32)	(6.06)	(7.04)	(1.86)	(3.65)	
Two	31.4	25.4	21.1	9.1	13.0	4
	(4.29)	(6.65)	(8.33)	(1.04)	(2.26)	
Three	30.4	25.8	22.7	8.1	13.0	3
	(4.49)	(8.49)	(14.28)	(2.08)	(3.18)	
Four	34.3	30.9	12.2	8.2	14.3	2
	(2.55)	(4.23)	(0.76)	(2.31)	(0.13)	
Five	32.9	35.4	12.7	6.2	12.8	1

Note: cells in columns 2 to 6 in a row add up to 100%. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 7 Number of FCP relations and trade values by product and country type in 2008

	Trade relations (number)		Trade value (billion euro)		Ave. trade value (100,000 euro)	
Product	**hom**	**hetero**	**hom**	**hetero**	**hom**	**hetero**
	57636	134319	45.3	43.0	0.79	0.32
Country	**EU**	**non EU**	**EU**	**non EU**	**EU**	**non EU**
	147288	77496	82.8	19.2	0.56	0.25
FCP	**new**	**recurrent**	**new**	**recurrent**	**new**	**recurrent**
	145711	191826	35.9	47.5	0.25	0.25

Source: International Trade Data of Statistics Netherlands, 2002 - 2008. hom is homogeneous and hetero is heterogeneous.

Table 8 Average share of decomposed FCP relations by birth year and over time by goods type (standard deviation between brackets)

survival year	New firms		New products		New countries		New country-products		Old country-products		Obs.
Good	**Hom**	**heter**	**hom**	**heter**	**hom**	**heter**	**hom**	**heter**	**hom**	**heter**	
Birth	9.9	8.5	27.6	31.9	23.2	22.2	10.3	15.1	28.9	22.3	6
	(1.33)	(0.40)	(1.65)	(1.79)	(1.17)	(1.37)	(1.43)	(1.14)	(1.62)	(0.51)	
One	12.7	10.1	23.9	27.5	25.1	25.8	7.4	11.2	30.9	25.4	5
	(1.57)	(1.12)	(2.69)	(3.26)	(2.20)	(3.08)	(1.02)	(1.49)	(0.45)	(1.41)	
Two	15.5	11.1	21.0	24.3	26.2	28.2	7.2	11.1	30.2	25.2	4
	(2.03)	(1.49)	(2.21)	(2.18)	(3.51)	(1.65)	(0.50)	(1.78)	(1.07)	(2.05)	
Three	16.8	12.0	20.1	22.1	27.4	30.1	6.3	10.7	29.4	25.1	3
	(2.22)	(1.71)	(4.18)	(1.84)	(4.97)	(1.46)	(0.51)	(2.30)	(1.25)	(2.40)	
Four	15.8	13.6	17.2	21.4	31.5	31.4	6.5	10.6	29.0	22.9	2
	(0.91)	(1.27)	(0.55)	(3.22)	(1.85)	(1.85)	(0.51)	(3.33)	(0.13)	(0.67)	
Five	17.1	13.1	17.6	18.9	30.7	32.8	7.1	13.4	27.5	21.8	1

Note: cells in a row add up to 100. Source: International Trade Data of Statistics Netherlands, 2002 - 2008. hom is homogeneous and heter is heterogeneous.

Table 9 Share of finishing FCP relations of new cohorts by survival year goods type

	2002		2003		2004		2005		2006		2007	
Good	**hom**	**heter**	**hom**	**heter**	**hom**	**heter**	**hom**	**heter**	**hom**	**heter**	**hom**	**heter**
2002	38.1	46.1	.		.		.		.		.	.
2003	14.2	15.5	55.5	65.1	.		.		.		.	.
2004	8.5	7.4	16.2	13.4	53.5	63.4	.		.		.	.
2005	5.7	5.3	6.6	6.1	16.1	13.9	53.7	63.0	.		.	.
2006	5.0	3.6	4.3	3.5	8.0	6.2	16.4	14.2	55.0	62.8	.	.
2007	3.7	2.6	3.5	1.8	5.1	3.0	7.6	5.5	14.8	12.9	49.3	58.9
2008	24.9	19.5	13.9	10.1	17.3	13.5	22.3	17.2	30.3	24.4	50.7	41.1

Note: cells in columns add up to 100. Source: International Trade Data of Statistics Netherlands, 2002 - 2008. hom is homogeneous and heter is heterogeneous.

Table 10 Average share of decomposed FCP relations by birth year and over time by country type (standard deviation between brackets)

survival year	New firms		New products		New countries		New country-product		Old country-product		Obs.
country	EU	non EU	EU	non EU	EU	non EU	EU	non EU	EU	non EU	
birth	10.7	6.7	33.8	27.5	19.1	26.7	11.6	16.8	24.8	22.3	6
	(0.79)	(0.45)	(2.48)	(0.86)	(1.84)	(0.79)	(1.78)	(0.81)	(0.83)	(1.00)	
one	13.1	6.8	29.0	21.4	22.7	31.9	10.1	10.1	25.1	29.8	5
	(1.20)	(1.25)	(3.89)	(1.52)	(3.36)	(1.75)	(2.12)	(0.90)	(1.39)	(0.93)	
two	14.9	7.5	25.1	18.2	25.3	34.2	10.6	8.2	24.1	32.0	4
	(1.56)	(1.78)	(2.08)	(1.21)	(3.29)	(2.76)	(2.31)	(0.91)	(1.53)	(1.04)	
three	15.4	8.8	22.9	16.8	28.0	34.6	10.2	6.8	23.6	33.1	3
	(0.27)	(2.55)	(2.02)	(2.91)	(3.04)	(4.07)	(2.73)	(1.26)	(1.77)	(0.95)	
four	16.2	9.5	20.8	15.1	30.8	36.4	10.3	5.5	22.0	33.4	2
	(0.45)	(1.70)	(0.49)	(4.96)	(1.17)	(6.43)	(3.73)	(1.55)	(1.61)	(1.77)	
five	15.8	9.4	30.8	10.7	20.0	40.9	7.1	4.4	27.5	34.7	1

Note: cells in a row add up to 100. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 11 share of finishing FCP relations of new cohorts by survival year by country type

	2002		2003		2004		2005		2006		2007	
country	EU	non EU	EU	non EU	EU	non EU	EU	non EU	EU	non EU	EU	non EU
2002	35.4	55.9	.		.		.		.		.	.
2003	15.5	14.6	55.4	71.4	.		.		.		.	.
2004	7.4	8.2	14.2	13.7	52.0	71.9	.		.		.	.
2005	5.7	5.0	6.8	5.8	15.3	13.3	52.0	71.4	.		.	.
2006	4.2	3.5	4.5	2.7	7.5	5.3	15.7	13.5	51.8	71.6	.	.
2007	3.0	2.5	2.6	1.6	4.1	2.7	6.6	5.2	13.6	12.8	70.5	58.9
2008	28.8	10.4	16.4	4.7	21.1	6.8	25.8	10.0	34.6	15.5	29.5	41.1

Note: cells in columns add up to 100. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 12 Average share of decomposed FCP relations by birth year and over time with only new entrants (standard deviation between brackets)

	New firms	New products	New countries	New cty prod	Old cty-prod	obs.
Birth	7.5	30.6	21.1	11.3	29.5	6
	(1.18)	(1.49)	(2.17)	(1.92)	(3.47)	
One	10.9	24.8	24.8	8.7	30.7	5
	(1.01)	(2.48)	(3.55)	(1.94)	(3.10)	
Two	13.1	21.7	27.4	8.5	29.3	4
	(1.94)	(0.62)	(2.62)	(2.34)	(2.91)	
Three	14.2	20.2	29.3	8.3	27.9	3
	(1.46)	(1.33)	(3.11)	(2.72)	(3.47)	
Four	15.2	18.7	32.1	8.6	25.4	2
	(1.69)	(0.49)	(0.63)	(3.70)	(2.15)	
Five	14.5	18.2	32.8	11.4	23.0	1

Note: cells in a row add up to 100. Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 13: Regression results of continuous and discrete hazard models

Method	Cox	cloglog	logit	probit	cloglog	logit	Probit
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Random effect	no	no	no	no	yes	yes	Yes
Log initial	-0.0793***	-0.0843***	-0.128***	-0.0773***	-0.153***	-0.197***	-0.115***
export	(0.00238)	(0.00340)	(0.00601)	(0.00347)	(0.00136)	(0.00178)	(0.00104)
no prod-	-0.000087***	-0.000111***	-0.000179***	-0.000107***	-0.000162***	-0.000215***	-0.000127***
countries	(8.79e-06)	(1.06e-05)	(1.99e-05)	(1.11e-05)	(2.97e-06)	(3.78e-06)	(2.18e-06)
Dum EU	-0.242***	-0.330***	-0.528***	-0.322***	-0.407***	-0.571***	-0.344***
member	(0.0131)	(0.0189)	(0.0331)	(0.0194)	(0.00743)	(0.0102)	(0.00605)
Dum	-0.0373***	-0.0343**	-0.0465	-0.0300*	-0.0798***	-0.0908***	-0.0503***
hom good	(0.0109)	(0.0170)	(0.0305)	(0.0177)	(0.00495)	(0.00667)	(0.00394)
Log dist	0.0265***	0.0311***	0.0392***	0.0252***	0.0601***	0.0771***	0.0455***
	(0.00449)	(0.00687)	(0.0119)	(0.00701)	(0.00296)	(0.00403)	(0.00239)
Log gdp	-0.00409**	-0.00247	0.000479	-0.000216	-0.0143***	-0.0216***	-0.0127***
	(0.00181)	(0.00295)	(0.00518)	(0.00305)	(0.00122)	(0.00174)	(0.00104)
Dum new	-0.261***	-0.475***	-0.975***	-0.553***	-0.103***	-0.166***	-0.0996***
firm	(0.0262)	(0.0321)	(0.0543)	(0.0320)	(0.00902)	(0.0119)	(0.00700)
Dum new	0.0636***	0.00311	-0.108***	-0.0444***	0.223***	0.278***	0.162***
product	(0.00937)	(0.0153)	(0.0294)	(0.0168)	(0.00599)	(0.00828)	(0.00492)
Dum new	-0.117***	-0.213***	-0.416***	-0.237***	-0.122***	-0.182***	-0.109***
country	(0.00968)	(0.0154)	(0.0293)	(0.0166)	(0.00664)	(0.00895)	(0.00529)
dum new prod	-0.0146	-0.156***	-0.448***	-0.237***	0.176***	0.197***	0.116***
-country	(0.0137)	(0.0223)	(0.0439)	(0.0254)	(0.00750)	(0.0105)	(0.00630)
Dum dur 1					1.363***	1.464***	0.780***
year					(0.0274)	(0.0286)	(0.0138)
Dum dur 2					0.831***	0.791***	0.382***
years					(0.0278)	(0.0293)	(0.0142)
Dum dur 3					0.517***	0.432***	0.186***
years					(0.0289)	(0.0305)	(0.0150)
Dum dur 4					0.355***	0.281***	0.116***
years					(0.0311)	(0.0331)	(0.0164)
Dum first					0.449***	0.550***	0.323***
spell				(0.0325)	(0.0379)	(0.0213)	(0.0227)
Dum second					0.188***	0.232***	0.142***
spell				(0.0328)	(0.0385)	(0.0216)	(0.0223)
Constant		0.417***	1.313***	0.779***	-1.391***	-0.800***	-0.396***
		(0.105)	(0.189)	(0.111)	(0.0611)	(0.0784)	(0.0451)
Observations	382807	382807	382807	382807	624464	624464	624464
Trade relations	13471	13471	13471	13471	382830	382830	382830
Log Likelihood	-3333230	-188279	-189766	-189326	-337545	-338720	-339286
χ^2	4619	6432	6445	7156	118112	105554	120370
χ^2 (ρ=0)					0.0713	0.0739	0.0269
ρ					5.58e-06	7.16e-06	4.83e-06

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses. All regressions also include year dummies which are significant.

Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Table 14: Test on the proportionality of the hazard function: the test on the Schoenfeld residuals

	ρ	χ^2	FD	prob > χ^2
Detailed test				
Log initial exports	0.03692	89.96	1	0
No prod-countries	0.00038	0.00	1	0.9527
Dum EU member	-0.01655	19.05	1	0
Dum hom goods	0.01013	4.57	1	0.0325
Log distance	-0.00288	0.76	1	0.3824
Log gdp	0.00418	1.71	1	0.1904
Dum new firm	-0.05023	68.21	1	0
Dum new product	-0.02103	37.18	1	0
Dum new country	-0.02288	51.55	1	0
Dum new prod-cty	-0.02318	34.08	1	0
Year dummies			4	
Global test		9116.25	15	0

Source: International Trade Data of Statistics Netherlands, 2002 – 2008.

Table 15: Robustness checks on dummies and observations (odds ratio)

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Spells	**all**	**first**	**all**	**all**	**all**	**all**	**all**
Log initial	0.821***	0.715***	0.727***	0.724***	0.789***	0.761***	0.817**
export	(0.00146)	(0.00219)	(0.00242)	(0.00222)	(0.00443)	(0.00182)	(0.00145
No prod-	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000**
countries	(3.78e-	(6.24e-	(6.97e-	(6.28e-06)	(7.06e-06)	(4.98e-06)	(3.77e-
Dum EU	0.565***	0.385***	0.383***	0.385***	0.489***	0.468***	0.565**
member	(0.00575)	(0.00661)	(0.00715)	(0.00666)	(0.00926)	(0.00635)	(0.00574
Dum	0.913***	0.890***	0.874***	0.887***	0.919***	0.877***	0.914**
hom goods	(0.00609)	(0.00993)	(0.0107)	(0.00996)	(0.00785)	(0.00777)	(0.00608
Log dist	1.080***	1.120***	1.122***	1.112***	1.081***	1.111***	1.083**
	(0.00435)	(0.00755)	(0.00827)	(0.00755)	(0.00569)	(0.00595)	(0.00436
Log gdp	0.979***	0.970***	0.978***	0.976***	0.983***	0.971***	0.976**
	(0.00170)	(0.00279)	(0.00306)	(0.00283)	(0.00214)	(0.00223)	(0.00169
Dum new	0.847***	0.879***	0.697***	0.700***	0.763***	0.811***	0.907**
firm	(0.0100)	(0.0173)	(0.0145)	(0.0140)	(0.0118)	(0.0128)	(0.0106)
Dum new	1.321***	1.530***	1.452***	1.372***	1.262***	1.460***	1.368**
product	(0.0109)	(0.0210)	(0.0224)	(0.0190)	(0.0143)	(0.0160)	(0.0112)
Dum new	0.834***	0.816***	0.756***	0.755***	0.814***	0.786***	0.853**
country	(0.00746)	(0.0123)	(0.0128)	(0.0115)	(0.00970)	(0.00937)	(0.00761
Dum new	1.217***	1.469***	1.270***	1.222***	1.165***	1.309***	1.288**
prod-cty	(0.0128)	(0.0255)	(0.0238)	(0.0215)	(0.0155)	(0.0183)	(0.0134)
Dum dur 1	4.325***				5.664***		4.042**
year	(0.124)				(0.385)		(0.116)
Dum dur 2	2.206***				3.839***		2.082**
years	(0.0645)				(0.167)		(0.0608)
Dum dur 3	1.541***				2.940***		1.483**
years	(0.0470)				(0.103)		(0.0452)
Dum dur 4	1.325***				2.298***		1.305**
years	(0.0438)				(0.0788)		(0.0431)
Dum first	1.733***			7.714***	4.759***	1.967***	
spell	(0.0657)			(0.446)	(0.249)	(0.0919)	
Dum second	1.261***			3.008***	2.339***	1.316***	
spell	(0.0485)			(0.176)	(0.110)	(0.0623)	
Constant	0.449***	31.49***	27.28***	4.251***	0.469***	2.886***	0.812**
	(0.0352)	(3.284)	(3.094)	(0.505)	(0.0603)	(0.272)	(0.0556)
Year dum.	yes	no	no	no	no	yes	yes
Observation	624464	624464	517005	624464	624464	624464	624464
Trade spells	382830	382830	317369	382830	382830	382830	382830
Log likeli.	-338720	-368302	-307498	-365411	-364873	-341037	-339478
χ^2	105554	26221	22598	28729	49142	73370	105103
ρ	7.16e-06	0.540	0.535	0.542	0.264	0.294	7.22e-06
χ^2 **(ρ=0)**	0.0739	33441	30273	34305	235.2	13533	0.0760

*** p<0.01, ** p<0.05, * p<0.1, Robust standard errors in parentheses. The coefficients are presented as odds ratios.

Source: International Trade Data of Statistics Netherlands, 2002 - 2008.

Annex

Table A1 Decay in export relationships (% of firm-country-product relationships)

	2003	2004	2005	2006	2007	2008
Decay in new firm export relationships (firm-country-product combis)						
2003	9.31					
2004	10.76	9.08				
2005	11.58	10.82	8.97			
2006	13.44	13.1	10.2	9.1		
2007	14.11	14.66	11.8	11.81	8.65	
2008	14.49	15.19	13.07	14.17	11.18	8.35
Decay in new firm-product export relationships (firm-country-product combis)						
2003	28.96					
2004	23.52	30.27				
2005	21.31	24.57	29.46			
2006	19.35	22.38	25.06	30.31		
2007	18.41	20.88	23.42	25.75	33.56	
2008	18.23	20.57	23.41	24.88	31.59	32.02
Decay in new firm-country export relationships (firm-country-product combis)						
2003	23.04					
2004	27.88	24.14				
2005	29.64	28.57	23.38			
2006	31.3	29.66	26.54	22.75		
2007	32.49	30.86	27.09	25.3	21.07	
2008	32.83	31.67	27.16	25.57	21.95	21.68
Decay in new firm-product-country export relationships (firm-country-product combis)						
2003	14.93					
2004	11.99	12.85				
2005	11.72	8.96	13.99			
2006	11.14	8.13	10.26	13.77		
2007	11.03	7.6	9.73	10.55	12.66	
2008	11.43	7.48	9.19	10.06	9.09	15.41
Decay in old firm-product country export relationships (firm-country-product combis)						
2003	23.77					
2004	25.85	23.66				
2005	25.75	27.07	24.19			
2006	24.76	26.73	27.92	24.06		
2007	23.96	25.99	27.96	26.59	24.07	
2008	23.01	25.09	27.17	25.31	26.19	22.53

Note that numbers per birth and survival year in the five blocks add up to 100%. Source: International Trade Data of Statistics Netherlands, 2002 - 2008**.**

Table A2 Decay in export value (firm-country-product combis in billion euro)

	2003	2004	2005	2006	2007	2008
Decay in new firm export relationships (FCP combinations)						
2003	24.02					
2004	25.93	23.51				
2005	27.62	28.88	19.97			
2006	29.92	33.65	23.89	27.38		
2007	32.41	34.74	27.17	32.28	16.78	
2008	32.9	36.02	27.29	35.71	21.15	13.78
Decay in new firm-product export relationships (FCP combinations)						
2003	29.04					
2004	34.13	26.45				
2005	36.05	24.19	26.17			
2006	35.92	25.61	20.72	21.99		
2007	34.11	26.13	21.69	21.97	17.26	
2008	35.37	28.13	19.01	22.32	18.57	25.17
Decay in new firm-country export relationships (FCP combinations)						
2003	21.73					
2004	17.15	20.97				
2005	13.6	18.64	29.71			
2006	12.43	14.86	33.8	24.59		
2007	12.78	12.65	31.87	19.94	32.7	
2008	12.72	11.7	37.28	20.08	27.44	37.99
Decay in new firm-country-product export relationships (FCP combinations)						
2003	12.6					
2004	9.31	14.51				
2005	7.93	13.88	11.99			
2006	7.35	10.22	9.7	13.81		
2007	6.51	10.51	8.51	12.09	15.37	
2008	6.22	9.77	6.58	9.64	11.56	10.2
Decay in old firm-country-product export relationships (FCP combinations)						
2003	12.61					
2004	13.48	14.56				
2005	14.8	14.41	12.16			
2006	14.38	15.66	11.89	12.23		
2007	14.19	15.97	10.76	13.72	17.89	
2008	12.79	14.38	9.84	12.25	21.28	12.86

Note that numbers per birth and survival year in the five blocks add up to 100%. Source: International Trade Data of Statistics Netherlands, 2002 - 2008**.**

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